



# Layout a Project





# OVERVIEW

- Familiarize you with techniques and procedures in staking / laying out a project using an Trimble S6 and R8 GPS
  - Controlled by a Data Collector (TSC2 / TCU)
- Cover two main concentrations:
  - **Upload** Civil Design Data
  - Layout Design Data at the Project Site





# Learning Objectives - TLO

- Provided written project design specifications, a survey set (G.P.), a design coordinate file, class IV and references, layout a project using **optical equipment** to the third order of accuracy. (1361-SRVY-1008)
- Provided written project design specifications, survey set (G.P.), class IV, and references, layout a project using **GPS equipment** to the third order of accuracy. (1361-SRVY-1011)





# Learning Objectives - ELO

- (1) Given a data collector, a computer workstation with terramodel software, a designed project, and with the aid of references, **upload the design data to a data collector** per the references. (1361-SRVY-1008a)
- (2) Given a **S-6 total station**, engineer stakes, a hammer, a designed project, a training area, horizontal control traverse stations, and with the aid of references, **perform station establishment** to the third order of accuracy. (1361-SRVY-1008b)
- (3) Given a **S-6 total station**, engineer stakes, a hammer, a designed project, a training area, horizontal control traverse stations, and with the aid of references, **stake out the project** to the third order of accuracy. (1361-SRVY-1008c)





# Learning Objectives - ELO

- (4) Given a **R-8 GPS** surveying system, engineer stakes, a hammer, a designed project, a training area, horizontal control traverse stations, and with the aid of references, **perform station establishment**, to the third order of accuracy. (1361-SRVY-1011a)
- (5) Given a **R-8 GPS** surveying system, engineer stakes, a hammer, a designed project, a training area, horizontal control traverse stations, and with the aid of references, **stake out the project** to the third order of accuracy. (1361-SRVY-1011b)





# **METHOD & MEDIA**

- **Lecture**
- **Demonstration**
- **Practical Application**
  
- **Slides**
- **Trimble Terramodel surveying software**
- **Dry-Erase**
- **Survey Set, GP**





# EVALUATION

- **Performance Evaluation**
- **When?**





# **SAFETY / CEASE TRAINING (CT) BRIEF**

- **See anything unsafe - Instructor says stop,**
  - **STOP IMMEDIATELY!!!**
- **FIRE!**
  - **Consolidate in the Pavilion**
    - **Account for everyone**
- **Tornado**
  - **1<sup>st</sup> Deck Passageway**
    - **Account for everyone**







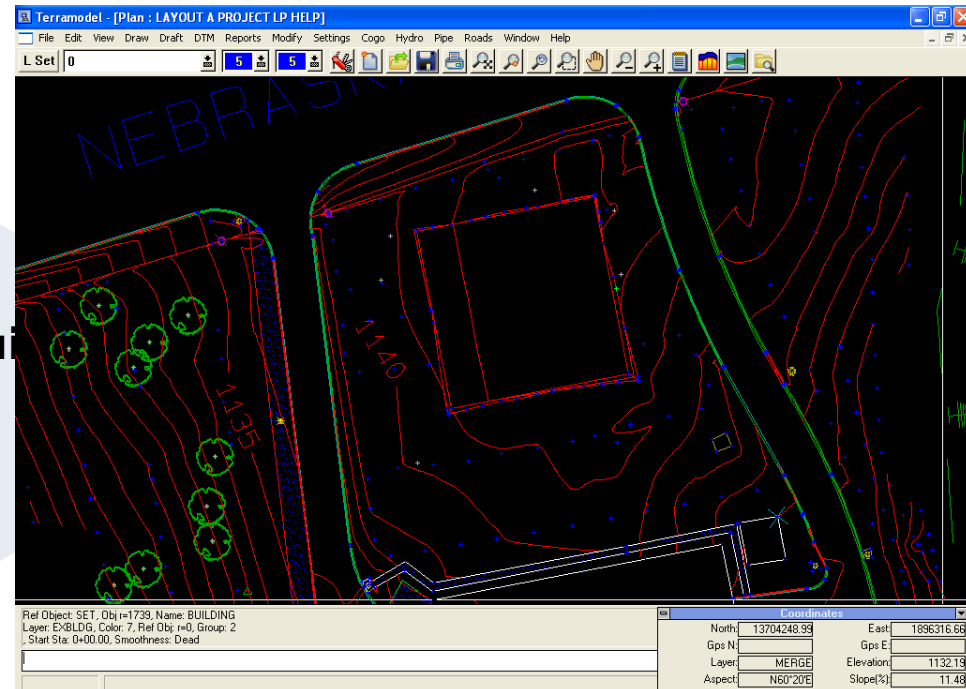
# 2





# UPLOADING CIVIL DESIGN DESIGN DATA

- Performed first before actual layout at the project site
  - Design data will be uploaded to the Survey Controller (TSC2 or TCU)
- 
- Controls your:
    - S6
    - R8
    - Third Party equipment





# **TRIMBLE TERRAMODEL Lecture / Demonstration**





# ?

Why is a hardcopy of a layout point listing helpful in the project site?

What is the purpose of a \*.DC  file?



# BREAK

## 10 Min





# SPOT CHECK

- **While the earthwork is ongoing, one of the tasks that will be asked of you is to spot check design elevations.**
  - **Comparing existing ground elevations to the design elevations at the project site.**
  - **Enables you to confirm and see how close the operators are getting to rough or finish grade per approved design elevations.**
    - **There are two file type extensions**
    - **(\*.DXF and \*.TTM) exported to the survey controller.**
    - **These two files will be selected (check marked) in the Active Map**







# **TRIMBLE TERRAMODEL Lecture / Demonstration**





# ?

**What is elevation spot checking?**

**What do exporting DXF and TTM files and check marked in the Active Map of the survey**







# BREAK

## 10 Min





# CONSTRUCTION LAYOUT SURVEYS

- **During this type of survey:**
  - **Grade stakes are set to establish the vertical alignment of subgrades and finish grades,**
  - **Slope stakes are set to establish the limits of earth moving operations, and culvert locations are established.**
  - **We will limit our scope to instrument, survey controller procedures in laying out the four corners and procedures of DTM elevation spot check.**





# **TRIMBLE TERRAMODEL Lecture / Demonstration**





# CONSTRUCTION LAYOUT SURVEYS

## Decimal Feet to Inches Conversion

### Why?

**Better visualize and understand 5-3/4" F material vice 0.477ft.**

**Preferred when giving numbers during Spot Check Elevations**

**Can be used to mark survey stakes**

**Inches to Decimal Feet Conversion Chart**

		0/8"	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"
0"	Decimal Feet	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07
1"	Decimal Feet	0.08	0.09	0.1	0.11	0.12	0.14	0.15	0.16
2"	Decimal Feet	0.17	0.18	0.19	0.2	0.21	0.22	0.23	0.24
3"	Decimal Feet	0.25	0.26	0.27	0.28	0.29	0.3	0.31	0.32
4"	Decimal Feet	0.33	0.34	0.35	0.36	0.38	0.39	0.4	0.41
5"	Decimal Feet	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.49
6"	Decimal Feet	0.5	0.51	0.52	0.53	0.54	0.55	0.56	0.57
7"	Decimal Feet	0.58	0.59	0.6	0.61	0.62	0.64	0.65	0.66
8"	Decimal Feet	0.67	0.68	0.69	0.7	0.71	0.72	0.73	0.74
9"	Decimal Feet	0.75	0.76	0.77	0.78	0.79	0.8	0.81	0.82
10"	Decimal Feet	0.83	0.84	0.85	0.86	0.88	0.89	0.9	0.91
11"	Decimal Feet	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99





# CONSTRUCTION LAYOUT SURVEYS

## Decimal Feet to Inches Conversion

- Convert 2.35ft cut/excavation to Feet-Inches.

**Answer: 2'-4 1/4"**

- Convert 3.62ft fill/borrow to Feet-Inches.

- **Answer: 3'-7 1/2"**

- Convert 1142.78sft elevation to Feet-Inches.

- **Answer: 1142'-9 3/8" elevation**





# ?

**What are the two procedures in the survey controller for staking out uploaded design points?**

**What are the steps in the survey controller for Spot Checking  design DTM elevations?**





# BREAK

## 10 Min





# TYPES OF STAKES AND MARKINGS







# **TYPES OF STAKES AND MARKINGS**

## **Alignment Stakes**

- **Indicate the horizontal alignment of the road**
- **Establish subgrade and finish grade elevations.**
- **Guide equipment operators during earth moving operations.**
- **Four types of Alignment Stakes:**
  - **Centerline**
  - **Grade**
  - **Slope**
  - **Offset**

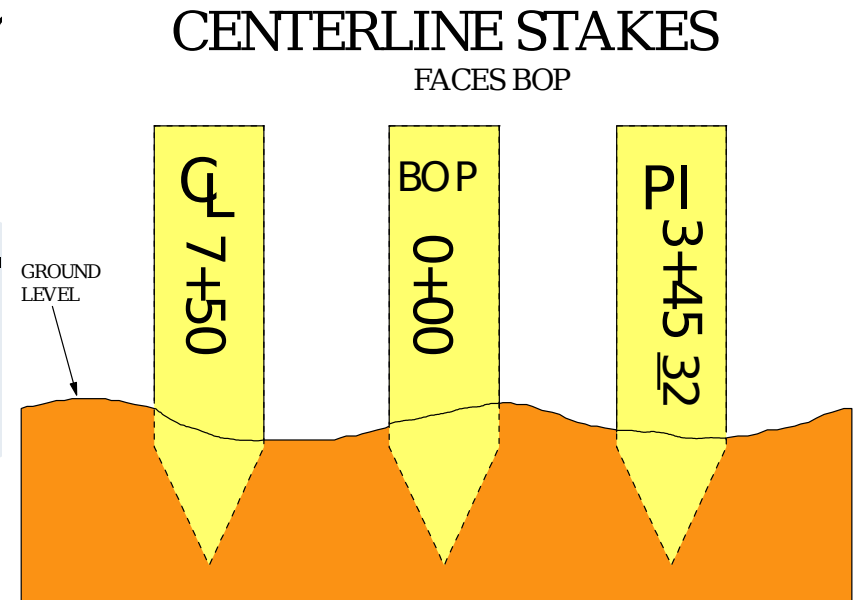




# TYPES OF STAKES AND MARKINGS, Cont.

## Centerline Stakes

- Establish the location of the road centerline (CL).
- Normally set at 100 foot station intervals starting at the beginning of the project (BOP), and proceeding to the end of the project (EOP).
- Marked with station values on the front.





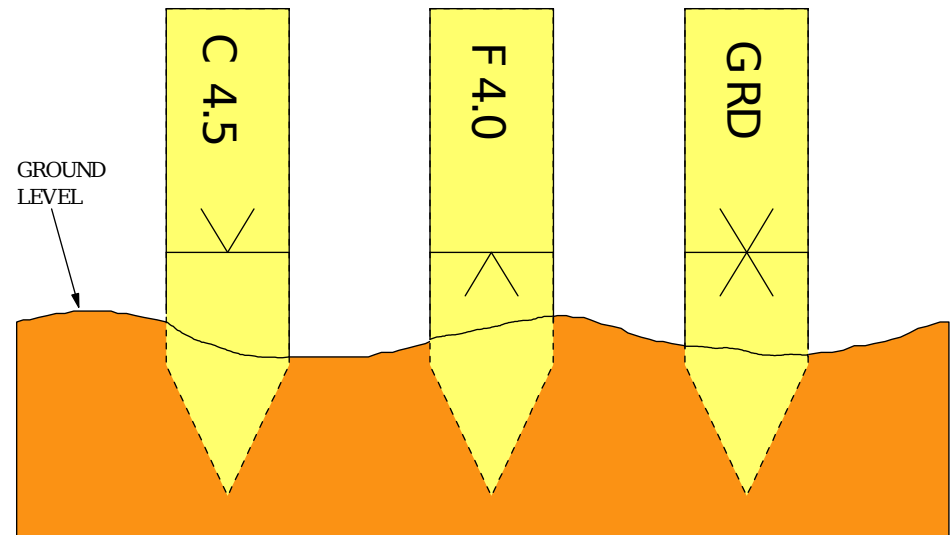
# TYPES OF STAKES AND MARKINGS, Cont.

## Grade Stakes

- Guide grading operations during the establishment of the vertical alignment (subgrade and finish grade) for a road.
- Indicate the amount of earth that must be cut or filled at each station.

### GRADE STAKES

BACK OF CENTERLINE STAKE FACING EOP

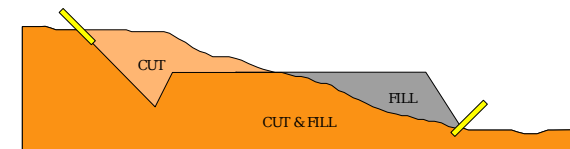
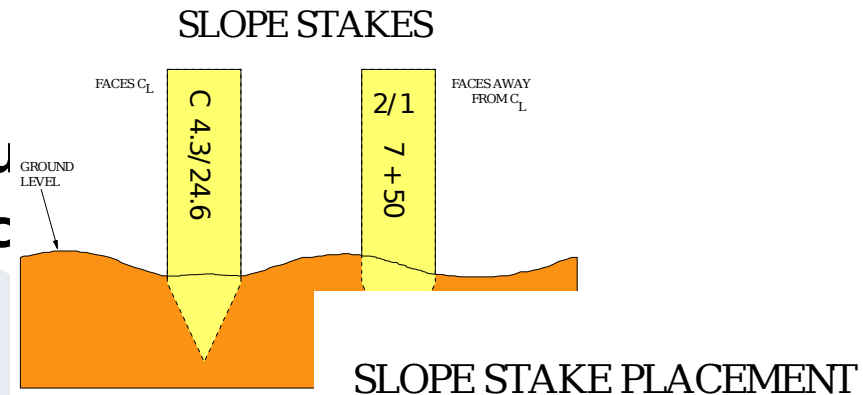




# TYPES OF STAKES AND MARKINGS, Cont.

## Slope Stakes

- Establish the earth moving limits left and right of the centerline.
- Placed at the left and right limits of the roadway.
- Identify the top of cut the back slope of a ditch the toe of fill on an embankment and are marked with station values and slope ratios.



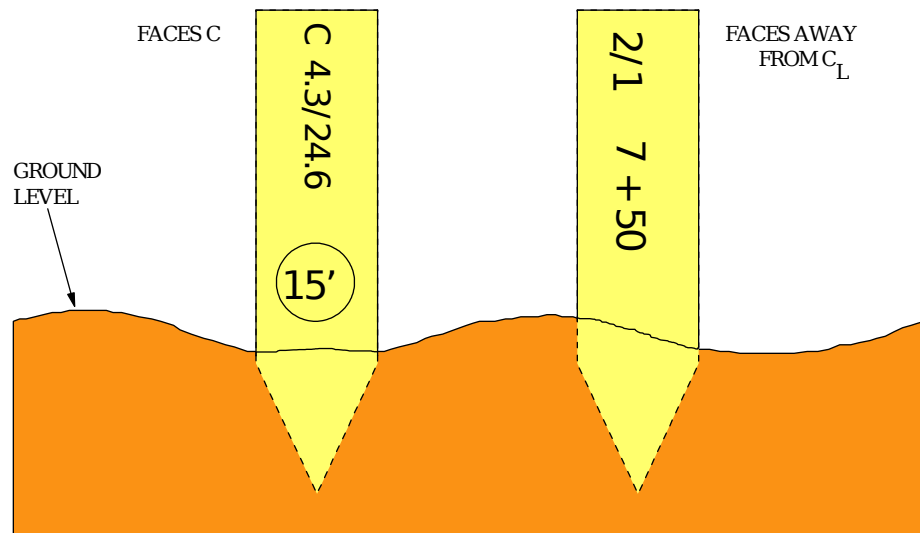


# TYPES OF STAKES AND MARKINGS, Cont.

## Offset Stakes

- Placed as references to the location of the slope stakes.
- Used as a backup for surveyors to reestablish critical alignment stakes that may have been disturbed

### OFF SET STAKE





# **COMPUTING AND MARKING CUT/FILL ELEVATIONS**

- **You need to be procedurally proficient and efficient on site.**
- 
- **We will look at the different situations and the procedures you can perform when you get up to a point to be staked and marked.**
- **Concentration are procedures for marking Grade Stakes.**





# COMPUTING AND MARKING CUT/FILL ELEVATIONS, Cont.

**Cut Design Elevation.** A point/corner where existing ground elevation is higher than design grade elevation.

- Survey controller displays: Existing ground elevation for that point/corner is 1144.00sft. Design elevation is 1142.78sft.
- Difference is 1.22ft or 1'-2 5/8". So from the point on the ground, it needs 1.22sft of cut/excavation.
- Cannot mark the stake underground. Needs to be visible for H.E.
- Simply add 0.50 or 1.00 to the 1.22ft value. 2.22ft or 1.72ft. However, the grade stake in place is only two feet tall. Use the lower value.
- Measure from the ground up 1.72ft. With a construction marker, write the cut symbol and the value of the cut. From the horizontal cut line, the





# **COMPUTING AND MARKING CUT/FILL ELEVATIONS, Cont.**

## **Fill Design Elevation.**

- You come up to a point/corner where the existing ground elevation is lower than design grade elevation.**
- Length of the grade stake you have is shorter than the actual fill material which will be poured on that spot.**
- Naturally you cannot mark the air.**







# COMPUTING AND MARKING CUT/FILL ELEVATIONS, Cont.

## Fill Design Elevation, Cont.

- Survey controller displays: Existing ground Elev is 1140.00sft. Design Elev = 1142.80sft.
- Difference is 2.80ft or 2'-9 5/8".
- Simply subtract 0.50 or 1.00 from the 2.80ft value. The values we come up with are: 2.30ft or 1.80ft.
  - Use the 1.80ft value
- Measure from the ground up 1.80ft
  - Mark the stake with the fill symbol and the value of the fill.
- Operators know that 1.80ft or 1'-9 5/8" above





# **COMPUTING AND MARKING CUT/FILL ELEVATIONS, Cont.**

## **Fill Design Elevation, Cont.**

- **What if you come up on a layout point where the fill grade marking symbol can be marked within the length of the emplaced grade stake and will be clearly visible for the Heavy Equipment operator?**
- **Simply mark the stake with the “Grade” symbol marking.**
- **Operators will know that the horizontal “Grade” line is where the fill material will come up to**





# **TRIMBLE TERRAMODEL Practical Application**





# ?

**Name the four alignment survey stakes?**

**Can you use feet-inch values on grade stakes?**





# SUMMARY

- **Techniques and Procedures in**
  - **Uploading Civil Design Data to a data collector**
    - **Points**
    - **\*.DXF / \*.TTM**
  - **Staking out a Project Site using both the S6 and R8**
    - **Elevation Spot Checks**
    - **Decimal Feet Conversions**
- **Different types of stakes and how to**

